

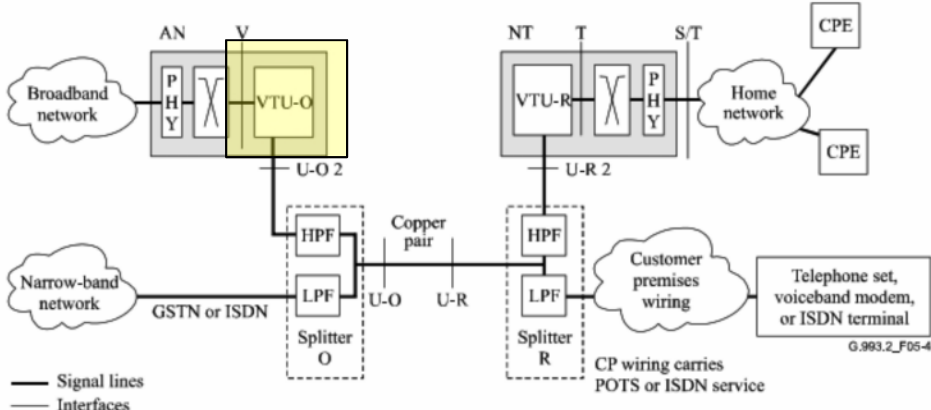
# **EXHIBIT 31**

Claim Chart for U.S. Patent No. 7,844,882 – [F3 – VDSL2 - Nokia](#)


<u><b>U.S. Patent No. 7,844,882</b></u>	<u><b>Infringement Allegations</b></u>
9. A system that allocates shared memory <sup>1</sup> comprising:	<p><b><u>ITU-T G.993.2 VDSL2 Standard</u></b></p> <p>The Accused Products operate in accordance with the VDSL2 (i.e., ITU-T G.993.2) standard and includes a system that allocates shared memory. <i>See, e.g., ITU-T G.993.2 (12/2011) at § 6.2.8 Aggregate interleaver and de-interleaver delay</i></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p><b>ITU-T</b></p> <p>TELECOMMUNICATION STANDARDIZATION SECTOR OF ITU</p> </div> <div style="text-align: center;"> <p><b>G.993.2</b></p> <p>(12/2011)</p> </div> </div> <p style="text-align: center;">SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS</p> <p style="text-align: center;">Digital sections and digital line system – Access networks</p> <hr/> <p style="text-align: center;"><b>Very high speed digital subscriber line transceivers 2 (VDSL2)</b></p>

<sup>1</sup> The VDSL2 standard requires the message exchange recited in these claims, though it does not expressly disclose how to share memory to enable that exchange. On information and belief, it is common industry practice to share memory in the manner in these claims, including in the Accused Products.

## Claim Chart for U.S. Patent No. 7,844,882 – F3 – VDSL2 - Nokia

U.S. Patent No. 7,844,882	Infringement Allegations
	 <p><b>Figure 5-4 – Generic application reference model for remote deployment with splitter</b></p> <p><b>6.2.8 Aggregate interleaver and de-interleaver delay</b></p> <p>The required aggregate interleaver and de-interleaver delay is specified in terms of the sum of the end-to-end delays in the upstream and downstream directions over both latency paths, expressed in octets. Therefore, it involves both VTUs. Figure 6-1 illustrates an end-to-end connection with two latency paths and their interleavers and de-interleavers.</p> <p>See also, e.g., ITU-T G.993.2 (02/2019) at § 6.2.8 Aggregate interleaver and de-interleaver delay.</p> <p><b>Testing</b></p> <p>Testing was performed on the 7330 ISAM XD.</p>

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<u><b>U.S. Patent No. 7,844,882</b></u>	<u><b>Infringement Allegations</b></u>
	
<p>a transceiver that performs:</p> <p>transmitting or receiving a message during initialization specifying a maximum number of</p>	<p><b><u>ITU-T G.993.2 VDSL2 Standard</u></b></p> <p>The Accused Products comprises a transceiver that performs transmitting a message during initialization specifying a maximum number of bytes of memory that are available to be allocated to an interleaver. <i>See, e.g.</i>, ITU-T G.993.2 (12/2011) at § 12.3.5.1 <i>O-PMS</i> and Table 12-56 – Description of message O-PMS:</p> <p>The O-PMS message is transmitted by the Accused Products during initialization:</p> <p><b>12.3.5 Channel analysis and exchange phase</b></p> <p><b>12.3.5.1 Overview</b></p>

Claim Chart for U.S. Patent No. 7,844,882 – [F3 – VDSL2 - Nokia](#)

U.S. Patent No. 7,844,882	Infringement Allegations															
bytes of memory that are available to be allocated to an interleaver;	<p>...</p> <p>The channel analysis and exchange phase involves the following steps as shown in Figure 12-10:</p> <ol style="list-style-type: none"><li>1) The VTU-O sends the O-MSG 1 message, which contains its capabilities and a number of (downstream) configuration parameters.</li><li>2) The VTU-R replies by sending the R-MSG 2 message, which indicates its capabilities.</li><li>3) The VTU-O sends the O-TPS message to indicate the configuration of the bearer channels and their required capabilities for both the upstream and the downstream directions.</li><li>4) The VTU-R acknowledges the O-TPS message with the R-TPS-ACK message.</li><li>5) The VTU-O conveys the upstream PMS-TC (framing) parameters by sending the O-PMS message.</li><li>6) The VTU-R conveys the downstream PMS-TC (framing) parameters by sending the R-PMS message.</li><li>7) The VTU-O sends the O-PMD message, which contains the bits, gains and tone ordering tables for the upstream PMD.</li><li>8) The VTU-R sends the R-PMD message, which contains the bits, gains and tone ordering tables for the downstream PMD.</li></ol> <p><b>Table 12-47 – VTU-O signals and SOC messages in the channel analysis and exchange phase</b></p> <table><tr><th>Signal</th><th>Signal type</th><th>Signal duration in DMT symbols with CE</th><th>SOC messages</th><th>SOC state</th></tr><tr><td>O-P-MEDLEY</td><td>Non-periodic</td><td>Variable</td><td>O-MSG 1, O-TPS, O-PMS, O-PMD</td><td>Active (RQ)</td></tr><tr><td>O-P-SYNCHRO 6</td><td>Non-periodic</td><td>15</td><td>None</td><td>Inactive</td></tr></table>	Signal	Signal type	Signal duration in DMT symbols with CE	SOC messages	SOC state	O-P-MEDLEY	Non-periodic	Variable	O-MSG 1, O-TPS, O-PMS, O-PMD	Active (RQ)	O-P-SYNCHRO 6	Non-periodic	15	None	Inactive
Signal	Signal type	Signal duration in DMT symbols with CE	SOC messages	SOC state												
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Table 12-56 – Description of message O-PMS

	Field name	Format
1	Message descriptor	Message code
2	MSGLP (Note 1)	1 byte
3	Mapping of bearer channels to latency paths	1 byte
4	B <sub>x0</sub>	1 byte
5	B <sub>x1</sub>	1 byte
6	LP <sub>0</sub> (Note 2)	Latency path descriptor
7	LP <sub>1</sub>	Latency path descriptor
8	max_delay_octet <sub>DS,0</sub>	3 bytes
9	max_delay_octet <sub>DS,1</sub>	3 bytes
10	max_delay_octet <sub>US,0</sub>	3 bytes
11	max_delay_octet <sub>US,1</sub>	3 bytes
12	Upstream SOS tone groups	Band descriptor
13	Upstream ROC parameters	ROC descriptor
14	ITU-T G.998.4 parameter field	Variable length
15	ITU-T G.993.5 parameter field	Variable length
16	ATTNDR_max_delay_octets <sub>DS,p</sub>	3 bytes

NOTE 1 – If the ROC is enabled, MSGLP shall be equal to 0.

NOTE 2 – If the ROC is enabled, the framing parameters for latency path #0 shall be contained in the ROC descriptor.

Field #7 "LP<sub>1</sub>" is a 10-byte field that contains the PMS-TC parameters for latency path #1 in the upstream direction. The "Latency path descriptor" format specified in Table 12-57 shall be used. If latency path #1 is not used, all bytes of LP<sub>1</sub> shall be set to ZERO.

Field #8 "max\_delay\_octet<sub>DS,0</sub>" is a 3-byte field that specifies the maximum value of delay<sub>octetDS,0</sub> (defined in clause 6.2.8), specified in bytes as an unsigned integer.